

## NATURAL RESOURCES CONSERVATION SERVICE CONSERVATION PRACTICE STANDARD

### WASTE TREATMENT LAGOON, (NUMBER)

#### Code 359

#### DEFINITION

An impoundment made by excavation or earthfill for biological treatment of animal or other agricultural waste.

#### PURPOSE

To biologically treat organic waste, reduce pollution, and protect the environment.

#### CONDITIONS WHERE PRACTICE APPLIES

This practice applies where: (1) an overall waste management system has been planned; (2) waste generated by agricultural production or processing needs treatment; (3) lagoon can be located near the source of the waste provided it meets the minimum separation distance from neighboring residence or public areas as governed by federal, state and local laws; (4) soils are suitable for retaining the waste or can be sealed; and (5) a water supply is adequate to fill the lagoon about half full before operation and to maintain the design depth when the lagoon becomes fully operational.

#### FEDERAL, STATE AND LOCAL LAWS

This standard is in addition to all federal, state, and local laws governing waste management, pollution abatement, and health and safety. The owner shall be responsible for obtaining all required permits and for compliance with such laws and regulations. Certification of compliance with this standard and specification DOES NOT ensure compliance with the other federal, state,

and local requirements. Some of the state laws and regulations are filed in Chapter 1, Agricultural Waste Management Field Handbook (AWMFH).

Any work involving the discharge of dredged or fill material into wetlands or other waters of the United States may require a permit according to Section 404 of the Clean Water Act.

#### PLANNING CONSIDERATIONS

**Type.** Waste treatment lagoons are of two general types -- anaerobic and aerobic, depending upon whether the predominant biological activity is anaerobic or aerobic. Mechanical aeration may be used in either anaerobic or aerobic lagoons. Anaerobic lagoons require less surface area than naturally aerobic lagoons but generally will give off odors.

Properly operating naturally aerobic lagoons are relatively odor free. Mechanically aerated lagoons are comparable in size to anaerobic lagoons and are generally odor free, but they require energy for aeration.

**Location.** The lagoon should be located near the source of waste and as far from neighboring dwellings as practical. If possible, locate the lagoon where prevailing winds will carry odors away from residences and public areas.

Runoff from outside drainage areas should not enter the lagoon. The lagoon shall not be located on a flood plain unless it is protected from inundation or damage by a 100-year frequency flood event.

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact the Natural Resources Conservation Service.

**NRCS, IA  
January 1997**

**Reviewed January 2002**

**Solids Removal.** A solids trap or a separator may be provided between the waste sources and the lagoon to remove solids from animal waste. If earth structures are used, a minimum of two should be planned so that one can be dried and cleaned while the other is functioning. Reduction in volatile solids (VS) by screening or settling may be considered in determining anaerobic waste stabilization volume. The reduction in lagoon volume will be determined by adjusting the VS by 50% of the VS removed. For example, if a swine facility produces 7000 lb. of VS per day and 2000 lb. are removed; the lagoon waste stabilization volume could be sized for 6000 lb. of VS per day.

**Water Storage Period.** Anaerobic lagoons shall be designed for either annual or semi-annual removal and disposal of wastes by land application.

## DESIGN CRITERIA

**Soil and Foundation.** Locate the lagoon on soils of slow to moderate permeability. Avoid gravelly soils and shallow soils over fractured or cavernous rock. See pond criteria in the Conservation Practice Standard, Waste Storage Facility (313).

**Waste Production.** Waste treatment lagoons are designed on the basis of 5-day biochemical oxygen demand (BOD<sub>5</sub>) or volatile solids (VS) loading. Design loading shall be based on the maximum weight of animals using the lagoon and other waste introduced. Information on waste production is provided in Chapter 4 of the Agricultural Waste Management Field Handbook (AWMFH)

**Loadings.** Anaerobic waste treatment lagoons are designed on the basis of a daily loading of 4 lb. of VS per day per 1000 cubic feet of lagoon volume. Maximum loading shall be as indicated in Chapter 10, AWMFH. If a higher

degree of odor control is necessary, loading rates should be decreased.

Naturally aerobic lagoons are designed on the basis of daily BOD<sub>5</sub> loading per acre of lagoon surface. Allowable loading shall be 30 lb. of BOD<sub>5</sub> per acre per day.

Mechanically aerated lagoons are designed on the basis of BOD<sub>5</sub> or ultimate BOD loading and on the basis of the equipment manufacturer's performance data for oxygen transfer and mixing. If used for odor control, aeration equipment shall provide a minimum of 1 lb of oxygen for each pound of BOD<sub>5</sub> contributed daily. For complete treatment, refer to the design procedures provided in Chapter 10, AWMFH.

**Depth.** The minimum depth of liquid shall be 6 feet for mechanically aerated and anaerobic lagoons, and 2 feet for aerobic lagoons. The maximum depth for mechanically aerated and anaerobic lagoons are dictated by the site and the equipment. The maximum depth for aerobic lagoons shall be 5 feet. Depth shall be measured between the lagoon floor and the water surface elevation in the lagoon, which provides the minimum required volume.

**Required Storage Volume.** The minimum size of an anaerobic lagoon shall be the summation of the waste stabilization volume, waste storage volume between disposal periods, precipitation storage and lagoon dilution volume. The design precipitation storage and dilution volume shall equal or exceed the volume of expected dilution and precipitation contributions to the lagoon system between disposal periods. Dilution volume shall not be less than 50% of the waste stabilization volume.

The maximum operating level shall be a sufficient distance below any automatic outflow device, pipe, or emergency spillway to provide storage for the 25-year, 24-hour precipitation on the

lagoon surface. The maximum and minimum operation levels shall be marked with a permanent liquid level gauge or marker to facilitate liquid level monitoring. Liquid level gauges shall be designed and located to allow monitoring from the basin perimeter. The minimum operating level after drawdown should normally be that level needed for the waste stabilization volume except when the lagoon is in drawdown to permit sludge removal or addition of dilution water.

**Bottom and Edges.** The bottom of aerobic lagoons shall be approximately level. The edges of all lagoons below the planned waterline shall be constructed as steep as soil conditions permit to reduce areas of shallow water and to inhibit weed growth. Excavated slopes shall be no steeper than 1.5 horizontal to 1 vertical.

**Earth Embankment.** The design height of the embankment shall be increased by the amount needed to insure that the design top elevation is maintained after settlement. This increase shall not be less than 5 percent. The minimum top width shall be as shown in the following table.

**Minimum Top Width Table**

Total Height of Embankment ft.	Minimum Top width ft.
0 to 4.9	8
5 to 14.9	10
15 to 24.9	12
25 to 35.0	14

The total height of the embankment is the maximum fill height at the centerline of the fill. The sideslopes of the constructed embankment will not be steeper than 3 horizontal to 1 vertical.

**Emergency Spillway.** An emergency spillway having a minimum flow depth of 1.0 foot and minimum bottom width of 10 feet shall be provided for all lagoons.

**Freeboard.** A minimum freeboard shall be provided as follows:

Maximum Water Surface Area	Minimum Freeboard
5 acres or less	2 feet
greater than 5 acres	3 feet

Freeboard is measured from the required storage volume (including the capacity for the 25-year, 24-hour precipitation) to the top of the embankment.

**Inlet.** If freezing is not a problem, an open inlet, such as a concrete channel, may be used. If freezing is a problem, the inlet shall consist of a pipe having a minimum diameter of 6 inches and a minimum slope of 1 percent, except that a minimum diameter of 4 inches may be used for milking center waste. The inlet pipe should terminate a sufficient distance from the shoreline to insure good distribution. It should be far enough below the surface to avoid freezing or be provided with other protective measures. Cleanouts should be provided in the pipe in case of blockage. A water-sealed trap and vent or a similar device shall be provided on pipelines from settling tanks or beneath the lagoon surface to prevent gases from entering the building. Inlet lines shall be of materials that will be watertight, that will not separate at the joints and that can withstand sunlight, weather, and earth and traffic loading.

**Outlet.** Waste treatment lagoons shall not discharge to surface waters unless the Iowa Department of Natural Resources determines that such discharge will not violate any established water quality standards.

Gravity outlet pipelines are not permissible.

**Protection and Safety.** If the lagoon will create a safety hazard, it shall be fenced and warning signs posted to prevent livestock, children and others from using it for purposes other than

**NRCS, IA**

**January 1997**

**Reviewed January 2002**

intended. The embankment and surrounding areas should be vegetated to control erosion. Vegetative screens or other methods should be used to shield the lagoon from public view and to improve visual conditions.

## **PLANS AND SPECIFICATIONS**

Plans and specifications shall be prepared in accordance with the criteria of this standard and shall describe the requirements for applying the practice to achieve its intended use.

The following list of Construction Specifications is intended as a guide to selecting the appropriate specifications for a specific project. The list includes most but may not contain all of the specifications that are needed for a specific project:

- IA-1 Site Preparation
- IA-3 Structural Removal
- IA-5 Pollution Control
- IA-6 Seeding and Mulching for Protective Cover
- IA-11 Removal of Water
- IA-21 Excavation
- IA-23 Earthfill
- IA-24 Drainfill
- IA-26 Salvaging and Spreading Topsoil
- IA-27 Diversions
- IA-31 Concrete
- IA-32 Concrete for Nonstructural Slabs
- IA-45 Plastic (PVC, PE) Pipe
- IA-81 Metal Fabrication and Installation
- IA-83 Timber Fabrication and Installation
- IA-92 Fences

## **OPERATION AND MAINTENANCE**

Operation and maintenance shall be performed according to the written operation plan provided for in the overall waste management plan.